

A bio-inspired optical compass for robotic applications*

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The desert ants *Cataglyphis* orient themselves by taking advantage of the polarized light which is scattered by the sky dome in the ultraviolet spectral range (UV). Recently, this sensory ability was implemented onboard a hexapod robot, called AntBot, allowing it to assess visually its heading with an accuracy as low as 0.4° [1-4]. This celestial compass, called MiMiCOMPAS is a first step toward a full vision-based navigation system helping robots to localize themselves in outdoor GPS-denied environments such as urban canyons.

The present work deals with both the design and the fabrication of an optical compass composed of an array of UV photodiodes that plays the role of the upper part of the ant eye, each photodiode being covered with a precisely oriented polarizing filter without adding any lens or optics.

In this preliminary study, we will first present the optical characterization bench and the methodology that made possible to develop this low-cost bio-inspired compass based on a group of 2 UV LEDs connected to a 7.5-decade logarithmic ratio amplifier (Fig. 1), as well as the mathematical algorithm based on the Malus' law that will allow the robot to automatically and accurately orient itself by means of the sky-scattered light. Finally, the whole acquisition chain, from the received photons to the generated signal, will be presented.

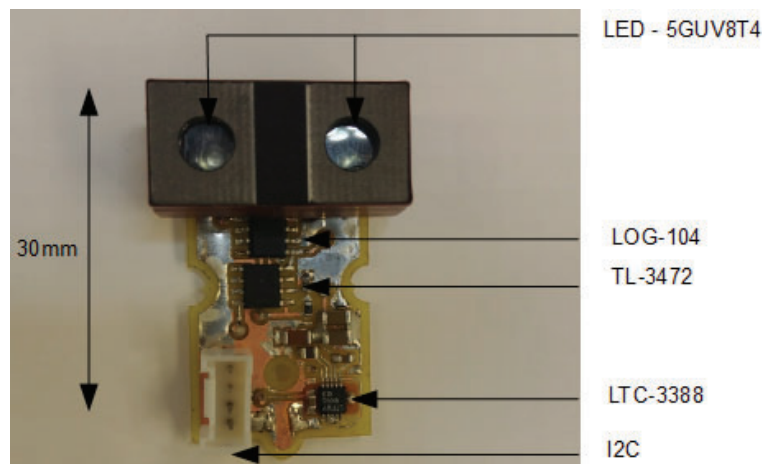


Fig. 1: Prototyped elementary unit of the MiMiCOMPAS celestial compass.

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